and undertreated public health problems."

Treatment based on TSH might not be simple, however, since osteoporosis can remain hidden for decades, says John R. Klein of the University of Texas Health Science Center in Houston. Still, the study "brings a new dimension into the way we think about how bone remodeling occurs," says Klein. "TSH, a molecule that few people would have ever imagined was involved in regulating bone remodeling, is in fact a major player in the process." —K. RAMSAYER

Bob, Bob, Bobbin' Along

Dinosaur buoyancy may explain odd tracks

Some of the heftiest four-legged dinosaurs ever to walk the Earth occasionally left sets of footprints that include only the imprints of their front feet. New laboratory and computer studies may explain what those animals were doing with their hind legs.

The sauropod group of dinosaur species consisted of large herbivores, some weighing up to 100 metric tons. These behemoths spent most of their time on all fours but may have reared up on their hind limbs to defend themselves or browse on high foliage. That posture can't explain the trails of sauropod footprints with no traces of hind feet.

Adding water to the equation, however, may solve the puzzle. Computer analyses of sauropod buoyancy conducted by Donald M. Henderson, a paleontologist at Canada's University of Calgary, suggest that floating sauropods of some species could indeed have made forefoot-only trackways.

Henderson's model divides a sauropod's body into many thin slices and calculates both the downward-acting weight and the upward-acting buoyancy of each slice. The model also accounts for body cavities, such as the lungs, and for appendages, such as the neck, tail, and limbs.

Brachiosaurus and *Camarasaurus*, sauropods that had relatively long front limbs and a balanced weight distribution, floated with their forefeet deeper than their back feet, Henderson found. So, they could have left prints of only their front feet as they moved through shallow water. However, *Diplodocus* and *Apatosaurus*, sauropods that had long tails and carried most of their weight over their rear legs, floated with their hind feet deeper than their front feet. That makes it almost impossible for them to produce forefoot-only trackways while partially floating, says Henderson. He presented results of his analyses last week at the annual meeting of the Society of Vertebrate Paleontology in St. Paul, Minn.

However, there still may have been a way for even those sauropods to have left no-hind-foot tracks, argue Jeffrey A. Wilson and Daniel Fisher of the University of Michigan in Ann Arbor. By placing 1/40-scale models of various sauropods on sensitive balances, the scientists measured the changes in weight borne by each creature's front and rear feet as the models were immersed in slowly rising water. When it reached wading depth for the sauropods, the water partially buoyed the models' tails and bodies. That would have shifted the animals' weights toward their front feet, Wilson says.

At certain water depths, all the sauropod models that Wilson and Fisher analyzed—both those with balanced weight distributions and those that were hip-heavy—exerted footprint pressures with their front feet that were more than twice those exerted by their rear feet. Therefore, says Wilson, it's possible that some sediments would record only the imprints of a wading dinosaur's front feet. He presented these findings at last week's meeting in St. Paul. —S. PERKINS

Super Spinner

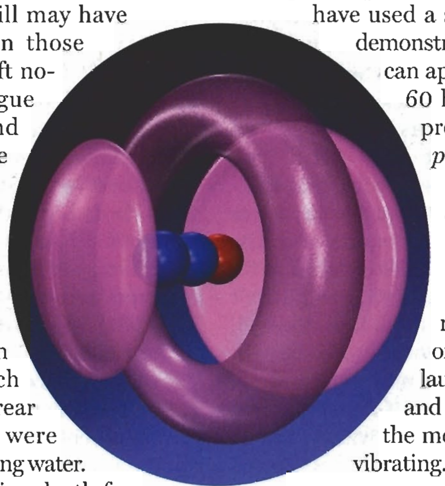
Seven-atom speck acts like superfluid

Superfluids are weird liquids that flow with no friction and can perform fantastic feats, such as spontaneously crawling over the walls of containers. Theorists have proposed that quantum-mechanical interactions among even a few atoms can give rise to such behaviors.

Now, researchers in Canada have evidence for the onset of superfluidity in a droplet containing a mere seven atoms of liquid helium-4. For now, isotopes of helium are the only substances known to exhibit superfluidity, which appears at temperatures just above absolute zero (*SN: 9/23/00, p. 207*).

Wolfgang Jäger and Yunjie Xu of the University of Alberta in Edmonton and A. Robert W. McKellar and Jian Tang of the National Research Council of Canada in Ottawa joined forces to make the discovery. The scientists observed signs of superfluid behavior in successively larger groupings of helium-4 atoms, starting with three atoms and building up to a cool dozen.

In past experiments, other scientists have used a similar approach to demonstrate that superfluidity can appear when as few as 60 helium-4 atoms are present (*SN: 4/25/98, p. 271*).



HELIUM BALLOONS Large ring marks where helium atoms first surround a nitrous oxide molecule. Hints of superfluidity start as additional helium atoms occupy hubcap-shaped end regions.

JÄGER

The Canadian researchers created the helium groupings so that each one was clustered around a molecule of nitrous oxide, better known as laughing gas. Microwave and infrared radiation set the molecule spinning and vibrating.

The first six helium atoms to accumulate are essentially dragged along with the rotating molecule at about 10 billion revolutions per second, Jäger says.

Helium atom number 7, however, altered the picture dramatically. The additional atom not only didn't join the merry-go-round, but its presence also somehow lessened the connections between the other six helium atoms and the nitrous oxide. Slippage started appearing between the spinning molecule and the surrounding helium—a first hint of frictionless flow—and continued with additional helium-4 atoms.

Jäger, McKellar, and their colleagues report their results in the Oct. 17 *Physical Review Letters*.

These new findings may be the first direct observation of superfluidity setting in as helium-4 atoms pile up to form a droplet, Jäger says. The observations also illuminate the physical nature of liquid-helium droplets engulfing molecules, he adds.

Some theorists regard these minuscule droplets as a mixture of two fluids—a normal fluid and a superfluid. Others argue that the droplets constitute a single superfluid of uneven density.

The new data "provide a far more interesting and demanding test of [superfluidity] theory than any previous experiment," says Kevin K. Lehmann of Princeton University, a proponent of the single-superfluid point of view.

Theorist K. Birgitta Whaley of the University of California, Berkeley points out that the new data actually fit nicely with previous theoretical studies based on the two-fluid model. —P. WEISS